Space Weather Technical Forecast

Issued on Sunday, 26 June 2022 at 13:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of Active electron fluence by day 3 (28th). Slight chance of G1 Minor geomagnetic storms on days 1 and 2 (26th/27th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained Low over the past 24 hours, with several small C-class flares. There are currently two sunspot regions on the visible disc, with the most notable region AR3038 Eho/Beta in the northwest. A CME was visible on imagery off the south of the Sun around 26/0400UTC. Due to the lack of SDO data it was not clear whether this was a front-sided or far-sided event. Analysis of all available data suggests are far-sided event is most likely. So, there are considered to be no new Earth-directed CMEs showing on available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured at L1, increased through the period to an elevated 550 km/s. This is likely due to the arrival of the High Speed Stream from negative coronal hole 95. Density was at or just above average levels. The Phi angle was predominately negative (towards the Sun). The total Interplanetary Magnetic Field (IMF) was moderate around 12 nT for much of the period, before eventually easing back to predominantly weak values around 5-7nT. The North-South component of the IMF, Bz, fluctuated sharply between negative and positive values, in the range -13/+9 nT. The resulting geomagnetic activity was Quiet to Unsettled (Kp 1-3), with Active (Kp4) intervals observed between 25/1800-26/0300 UTC and 26/0900-1200 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) as measured by GOES16 remained at Background levels through the period. High energy electron flux (greater than 2MeV) peaked at High levels, with 2040 pfu observed at 25/1520 UTC, but dropped out to mainly background since 25/1730 UTC. The corresponding 24-hour electron fluence remained below the Active threshold (1e8 integrated pfu) with an observed fluence of 3.18e7 integrated pfu at 26/0001 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low to very Low, with only a slight chance of increasing to Moderate with any M-flares that occur.

Solar Wind / Geomagnetic Activity: The CME from the 24th is expected to miss, passing just ahead, but may give a glancing blow early on day 3 (28th). Solar winds are expected to remain elevated on day 1 and then persist at this level due to fast wind enhancement from CH95/-, with further influence from CH93/- and CH94/-, before gradually easing day 3 (28th). Geomagnetic activity is likely to be mainly Unsettled with Active intervals and a slight chance of G1/Minor Storms during any extended periods of negative Bz on days 1 and 2 (26th or 27th). Before easing to Quiet with Unsettled spells and a slight chance of Active intervals from day 3 (28th).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to remain at Background, with only a very slight chance of rising above this level due to the location of AR3038 and any flaring that may occur from this region. The high energy electron flux (greater than 2 MeV) may start to recover depending on whether we see any significant geomagnetic activity. Flux levels likely reaching High day 2 (27th) onward. Corresponding electron fluence is expected to develop a rising trend, with a chance of Active (1e8 integrated pfu) fluence from day 3 (28th).

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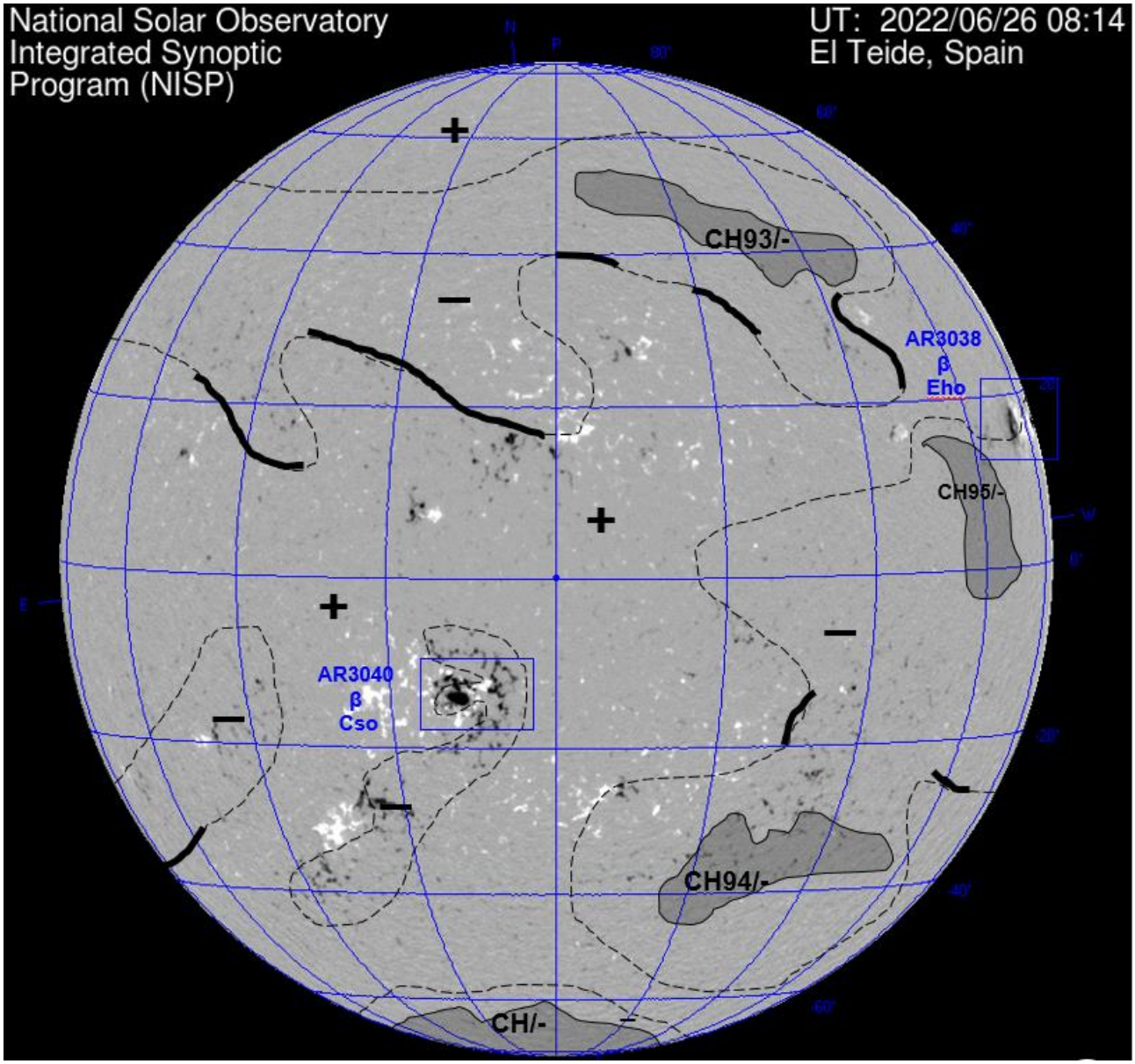
Figure 1. Solar Analysis Valid 26/0800UTC (completed without SDO imagery).



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no significant CMEs on the Earth-Sun line, however a filament eruption on the 24th produced a weak CME that was visible on STEREO A cor2 imagery. This has been assessed as passing just ahead of Earth, but may give a glancing interaction early on day 3 (28th), although this assessment is low confidence due to the lack of significant CME signal on SOHO coronagraphs.

Current solar wind conditions observed at L1 suggest Earth has connected to the High Speed Stream from CH95/-. Ongoing solar wind enhancement is also possible on day 2 (27th) with influence from CH93/- and CH94/- before easing from day 3 (28th).

Geomagnetic activity is likely to be mainly Unsettled with Active intervals and a slight chance of G1/Minor Storms in any extended periods of negative Bz at first. This easing to Quiet with Unsettled spells and a slight chance of Active intervals from day 3 (28th). Perhaps increasing again to Unsettled to Active with any glancing CME interaction early day 3 (28th), however this is a very low risk.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

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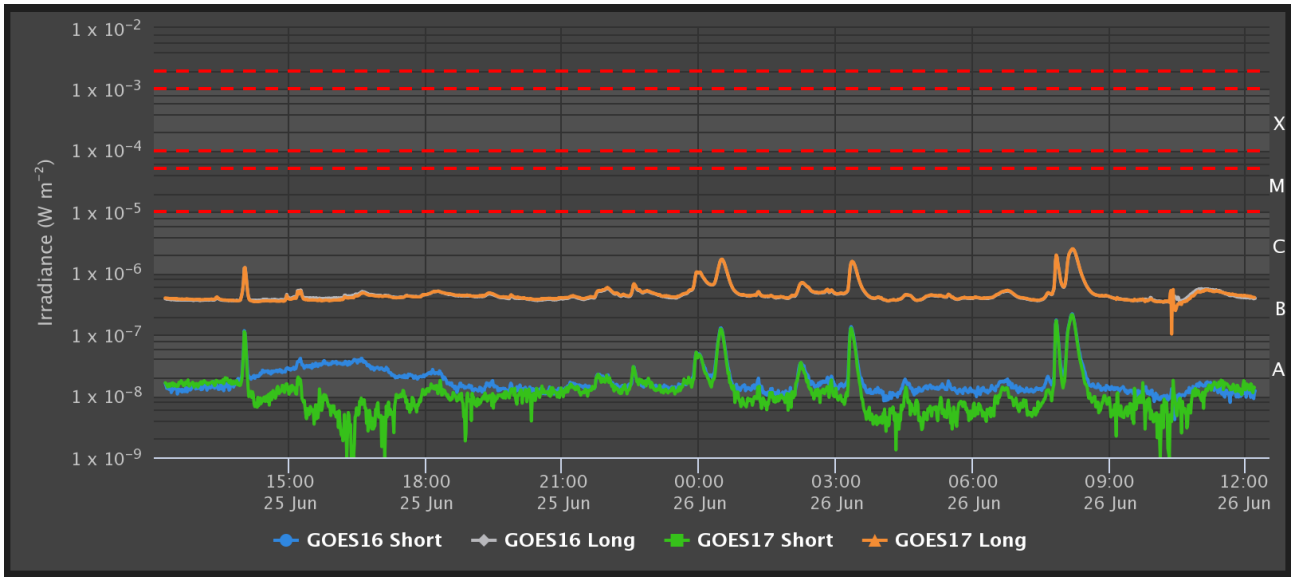
Radio Blackouts - X-Ray Flares:
There are currently two active regions on the visible disc. The most prominent and largest of these regions is AR3038 Eho/Beta in the northwest, however this region has remained relatively stable, with a simple magnetic configuration. AR3034 has now rotated around the west limb, while AR3038 Cso/Beta in the southeast disc remains small and simple.
Activity has remained Low with several small C-flares in the last 24 hours, and is expected to persist either at Low or Very Low throughout. There is a slight chance of increasing to Moderate with isolated M-flares.

(Please note, SDO imagery is currently unavailable leading to a lack of high-resolution imagery for analysis. Consequently the current solar assessment is based primarily on GONG imagery supported by imagery from GOES SUVI).

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: GOES16 X-Ray flares



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and will most likely remain at this level through the period. There is a very slight chance of proton levels rising above background should any notable flare occur from AR3038 due to its location, now approaching the northwest limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux, as observed by GOES-16, has dropped out to background levels, likely due to the arrival of the CIR of anticipated CH95/-, followed by the arrival of its High Speed Stream.

Flux levels are expected to build through day 1 (26th), and likely becoming generally High from day 2 (27th) onward. Any CME glance that occurs early on day 3 (28th) may lead to a drop out in values, however this is very low confidence.

The associated 24 hour fluence is expected to remain below the Active level at first, but rising with a chance of breaching the Active (1e8) threshold from day 3 (28th), similar to the previous rotation, but around 24 hours later than a standard 27-day persistence would suggest. This is currently not indicated by REFM, though the model increasing trend is considered good advice.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	10	30	50
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Observed fluence levels below 1e8 integrated pfu Active threshold. Forecast increasing trend is likely to be accurate.

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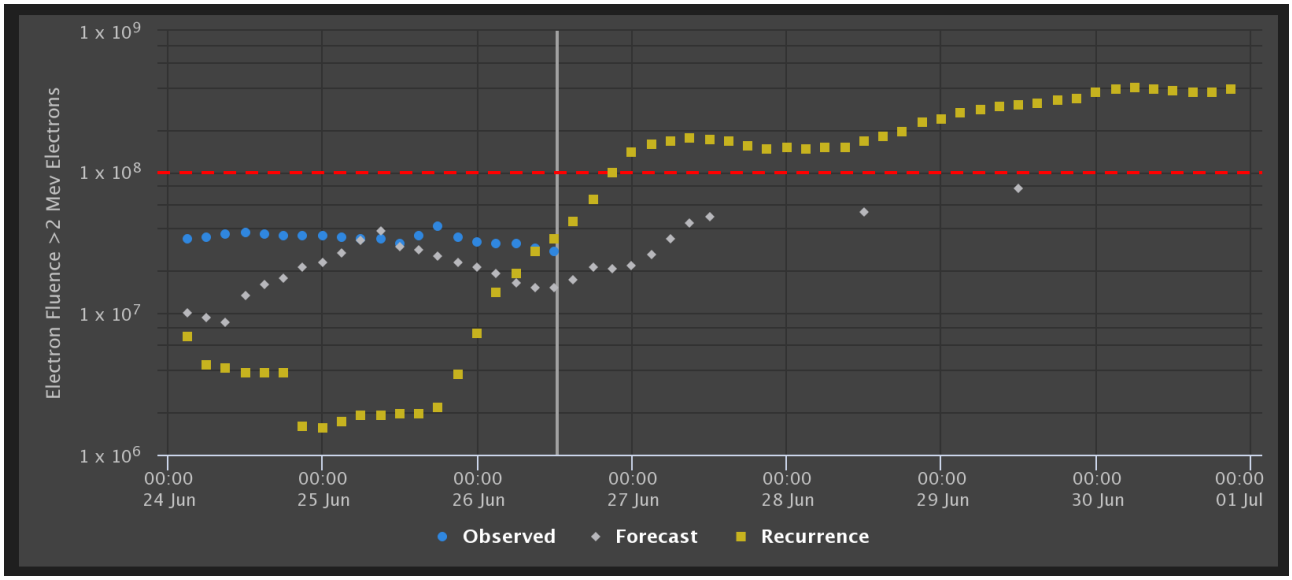

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